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Mr. Alan G. Whalon
Superintendent, Chiricahua National Monument
USDI National Park Service
13063 E. Bonita Canyon Road
Willcox, AZ 85643

Dear Mr. Whalon;

On September 20, 2005, Bobbe Fitzgibbon, entomologist with our Forest Health staff, visited the Chiricahua National Monument to evaluate the level of Arizona cypress mortality and overall general health of Arizona cypress on the Monument. Based on Bobbe's visit and subsequent discussion between you and Joel McMillin (entomologist on our staff), we describe in this report the level of Arizona cypress mortality that was observed in areas surveyed, summarize treatments to reduce mortality of Arizona cypress, and make recommendations for protecting these valuable trees at the Monument.

Arizona cypress mortality in the Chiricahua National Monument

Throughout the state of Arizona, and in particular the Southeast portion of the state, Arizona cypress trees have been experiencing relatively high levels of mortality over the past few years. This mortality has been primarily caused by the cypress bark beetle (*Phloeosinus cristatus*) attacking drought-stressed trees. Accompanied by you, Bobbe surveyed the condition of Arizona cypress trees growing near the Visitors Center, the Bonita Campground, and in Echo Canyon. Based on these surveys, a moderate level of cypress bark beetle activity was found with tree mortality approximately 15 – 30 percent. An additional 10 – 15 percent of the trees showed signs of beetle attack in branch tips which has caused the branch tips to fade (a condition called "flagging") or had been top-killed (***Figure 1***). Nearly all size classes of mature Arizona cypress were being attacked by cypress bark beetles.

Figure 1. *Top-kill and mortality of Arizona cypress at Bonita Campground.*

Cypress bark beetle biology and ecology

The following description of cypress bark beetle biology and ecology is based on the University of Arizona Cooperative Extension Publication AZ1316 (Schalau 2003) and Western Forest Insects (Furniss and Carolin 1977). Cypress bark beetles are native insects that occur throughout Arizona. Adult cypress bark beetles are small (2-4 mm long) and a shiny reddish brown to black color. Adult beetles colonize the bole (trunk) and larger branches of the tree where they mate and lay eggs. Egg galleries are 25-75

mm in length and run in a longitudinal direction arising from an enlarged chamber. Eggs are laid in closely spaced niches on either side of the gallery. After the eggs hatch, the larvae feed perpendicular to the egg gallery. The resulting final egg plus larval feeding gallery is shown in ***Figure 2***.

As the larvae consume the inner bark (phloem), cambium, and outer sap-wood, the tree is girdled cutting off the flow of nutrients to the lower portion of the tree. Beetle colonization often causes top-kill and branch mortality, but can lead to tree mortality. Trees are colonized in the spring and summer. Although there is a paucity of data on life cycle development time, flight periodicity, and the number of generation(s) that occur per year, it is generally thought that one generation per year is common, but more generations may be possible under the right conditions.

Newly emerged adults fly to a new host tree where they bore into small twigs a few inches from the branch tips. Mining of branch tips causing it to fade in color and die. The dead branch tip remains hanging on the tree (called "flagging") for a short period before breaking off. Upon close inspection of the branch tips, a hollow area can be seen where the beetle mined the twig. This beetle and other closely related *Phloeosinus* species attack Arizona cypress, Leyland cypress, eastern red cedar, and other native Juniper trees. Cypress bark beetles mate and oviposit in the limbs and trunks of weakened, broken, dying, or felled trees and are common in juniper firewood. Cypress bark beetles seldom cause mortality in healthy, vigorous trees. However, when host trees are drought stressed, bark beetle populations increase allowing the beetles to colonize seemingly healthy trees. Natural stands of Arizona cypress are often found in riparian areas or where precipitation is higher than adjacent areas. Therefore, during drought episodes when these normally wet sites become dry, cypress trees can become severely stressed and susceptible to bark beetle attack.

Figure 2. *Egg and larval galleries of cypress bark beetle.*

Treatments for reducing cypress bark beetle impacts

Little research has been conducted on the control of cypress bark beetles and direct control is not typically conducted in a forest setting. Therefore, control or prevention is recommended only for higher value trees in an ornamental setting or developed recreation and administrative sites.

1. **Cultural practices** can significantly reduce potential beetle colonization. Maintaining tree health and vigor will reduce the risk of beetle colonization. This is accomplished by slow, deep, infrequent irrigation of susceptible trees species during extended drought periods (April-June or longer) using a drip irrigation system or a soaker hose placed at the drip line of the tree.

2. **Silvicultural treatments.** Although no experimental work has examined relationships between stand conditions (composition of tree species in the stand, tree density, tree size or age) and susceptibility to attacked by the cypress bark beetle, any silvicultural treatments which improve the overall vigor of trees within stands will likely decrease individual tree

susceptibility to attack in the long-term. Furthermore, treatments which favor a greater mix or diversity of tree species in a stand will reduce potential impacts caused by beetles.

3. **Sanitation treatment or removal.** Sanitation treatment or removal involves cutting of currently infested trees prior to the beetle maturation and emergence. On site treatments of infested trees include cut and burn, cut and burying, cut and chip, or cut and debark. If an infested trees is to be removed from the site, it needs to be moved a minimum of one mile from the nearest live host type prior to beetle emergence. These treatments will help to reduce beetle populations in localized areas and in individual stands. This can provide some protection to surrounding uninfested trees and stands by removing a large source of attacking beetles. Sanitation removal is only effective at suppressing beetles at the stand level; it is not typically effective on a landscape scale. In addition, this treatment does not address stand conditions that may have contributed to the initial increase of beetle populations.

4. **Protection of high value trees.** Valuable trees in recreation sites or near administrative structures may be sprayed with insecticides labeled for bark beetles to prevent successful attack. Both the trunk and large branches should be sprayed. Attacking beetles die as they attempt to chew through the bark. Preventive sprays are not recommended for trees already attacked. In addition, systemic injections of insecticides have not shown to be effective for bark beetles, either as a preventive or a direct remedial control of bark beetles on pine (Haverty et al. 1996).

Recommendations

Because the current beetle infestation is occurring on the landscape scale and is largely a result of the ongoing drought, it is essentially impossible to control the beetle population as a whole through management actions. Therefore, control and prevention actions should be limited to the most critical, high-value areas that have adequate accessibility. Based on the current weather and stand conditions, setting, and relatively large population of bark beetles within the immediate area, trees within many of the recreation and administrative sites continue to be highly susceptible to beetle attack. Therefore, a combination of removal of infested trees, application of preventive insecticide sprays, and cultural treatments are recommended for four of these sites (entrance station, Faraway Ranch, Bonita Campground, and the Visitors Center).

In the short-term, prompt removal of currently infested trees will help to reduce the immediate local population of beetles. However, because these insects are very common, removal of infested trees is not a guarantee of protection. Therefore, this approach is recommended in combination with preventative spraying and cultural treatments (irrigation) while beetle populations remain high. It is recommended that the infested trees be removed yet this fall before the brood completes their development and adult beetles emerge. Felling of infested trees will not kill developing brood; infested trees must either be removed from the site or treated on site.

Strategies for applying the preventive sprays have been developed by other Forests in Arizona and the West. It has been suggested that 5 to 10 trees per campsite or picnic area are needed to provide adequate shade and screening. This general guide can be used for determining the number of trees to be sprayed within a campground or day-use area. Candidate trees include those that have good structural form and are in close proximity to tent pads, cooking areas and

picnic tables. If the Monument is considering spraying, further guidelines and safety plans can be provided.

Sincerely,

/s/ John Anhold
JOHN ANHOLD
Arizona Zone Leader Forest Health

cc:
Joel McMillin
Bobbe Fitzgibbon
Leonard Lucero
Debra Allen-Reid